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None

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INT CL[5] H01R 39/42 39/44, H02K 5/14 13/00
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(54) Adjustable brushes for ease of assembly in a commutator motor

(57) To facilitate assembly the brush leaves (3) of a fractional horsepower PMDC electric motor, are mounted in brush holders (4) formed integral with the end cap (2) of the motor, each brush holder (4) being connected to a central portion (7) of the end cap (2) by means of a deformable interconnecting portion (6) and extends across an aperture (9) formed in the outer rim (8) of the end cap (2). Wedging members (5) disposed between the brush holders (4) and adjacent sides of the apertures (9) swing the brush holders (4) from a first position in which the brush leaves (3) are clear of the motor commutator (2) (right hand half of figure) into a second position in which the brush leaves engage the commutator with the required pressure (left hand half of figure).

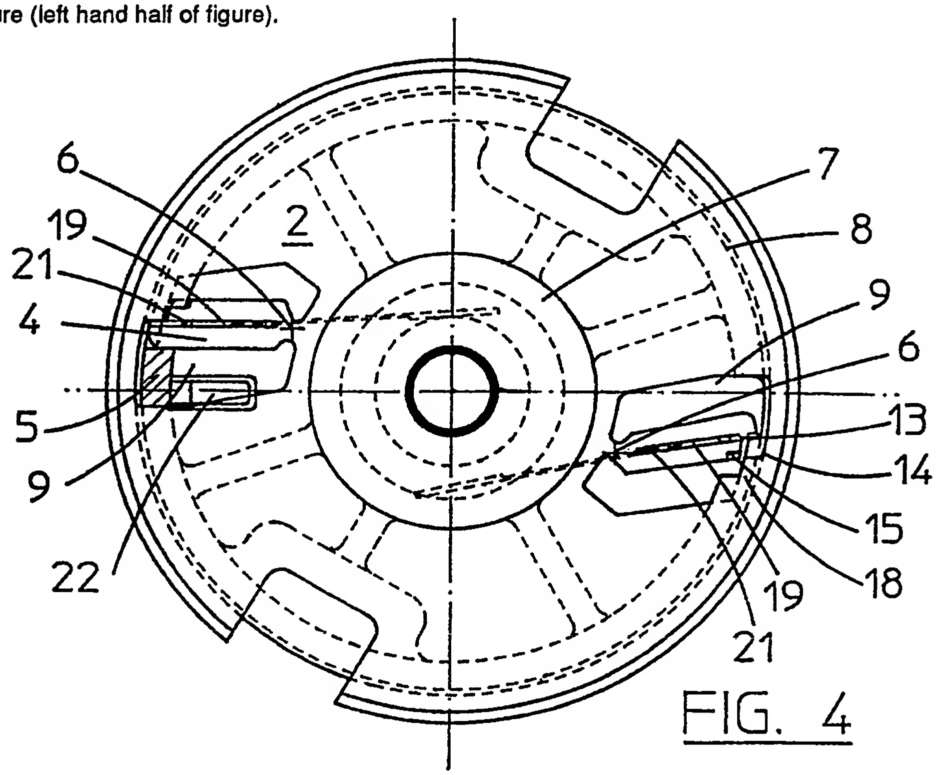

FIG. 4

At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

This print takes account of replacement documents submitted after the date of filing to enable the application to comply with the formal

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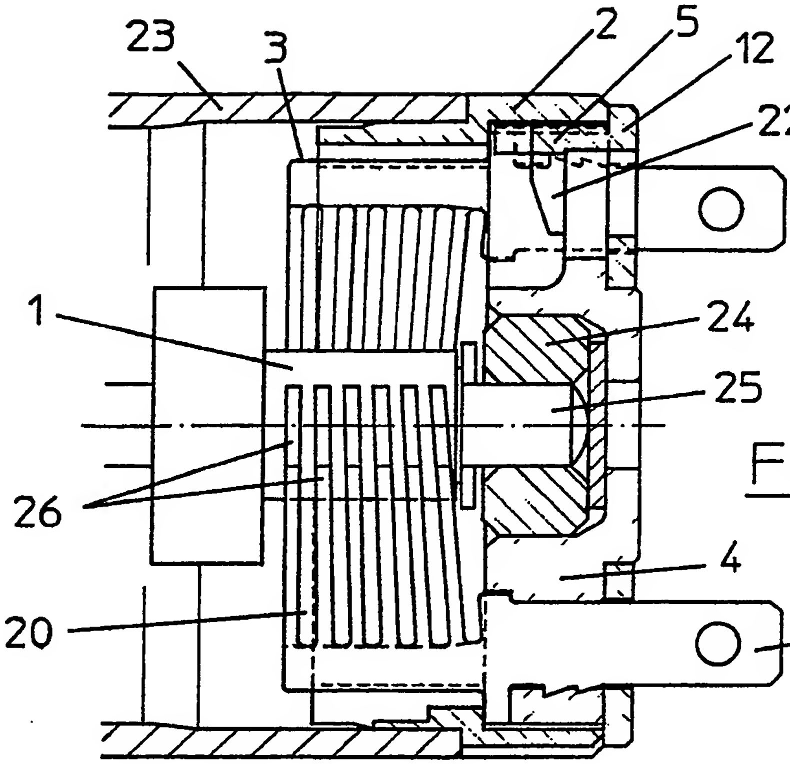

FIG. 1

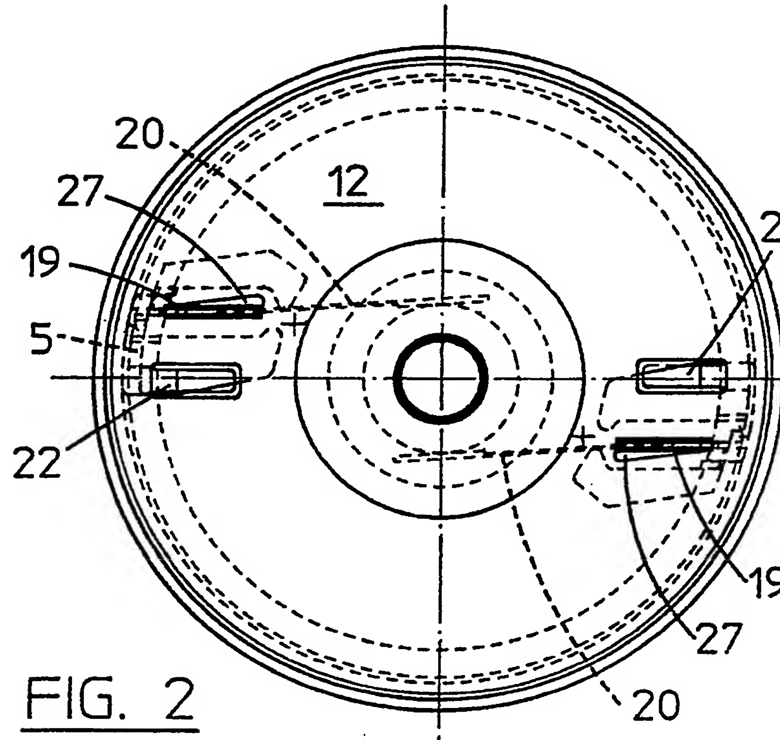

FIG. 2

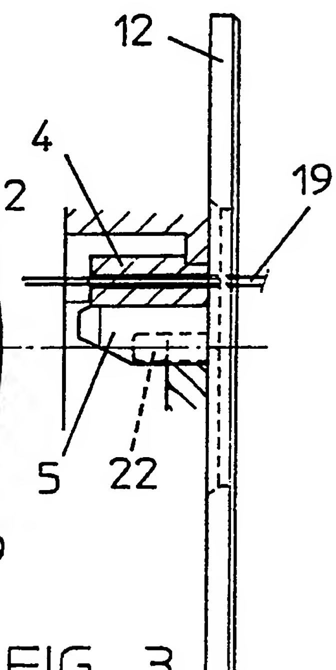

FIG. 3

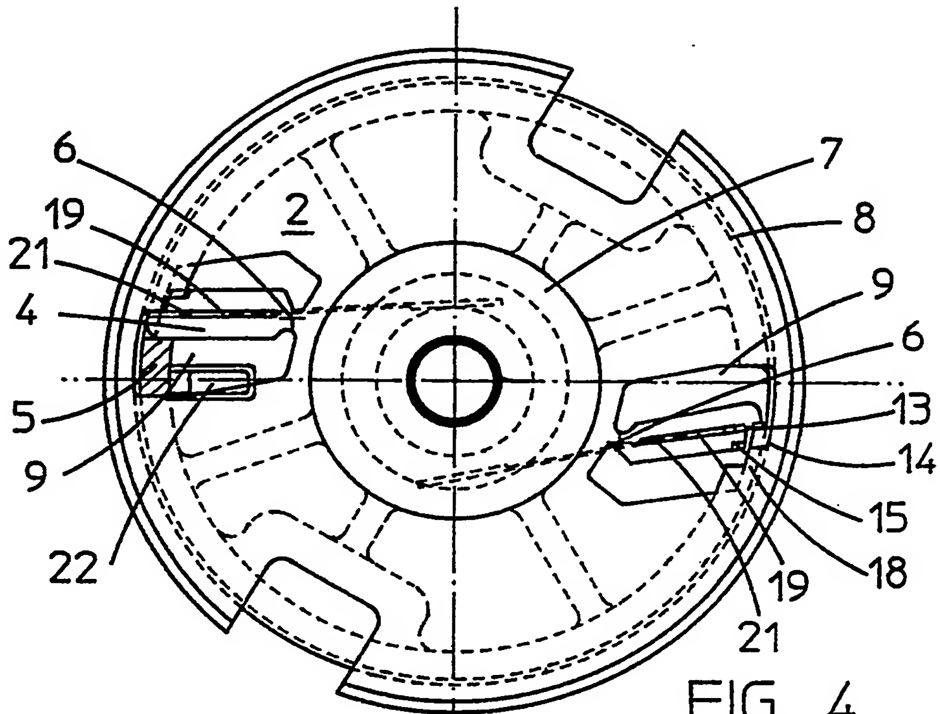

FIG. 4

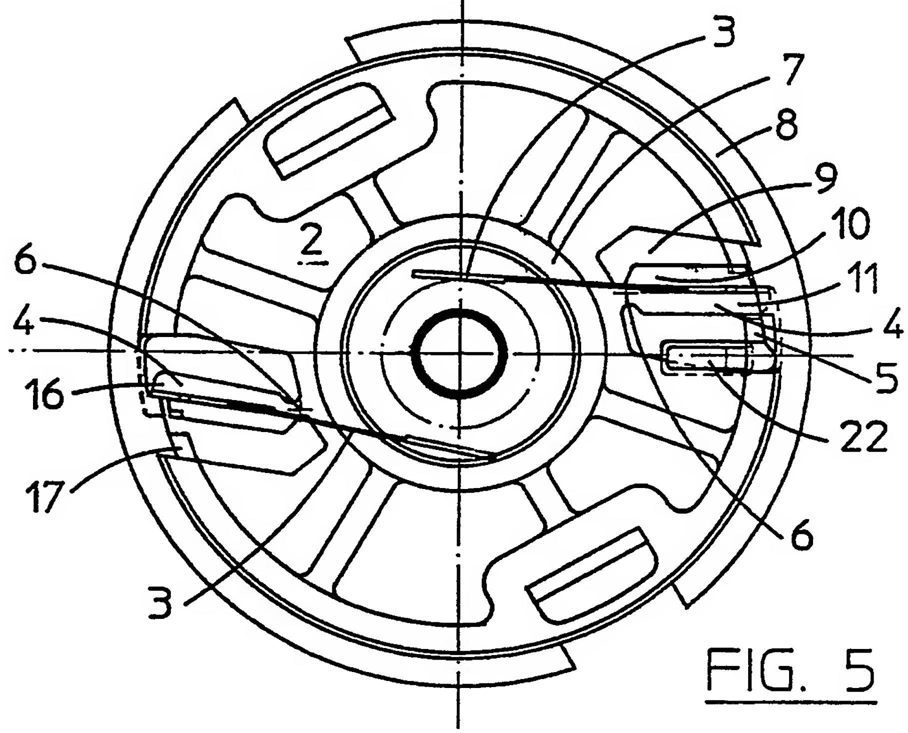

FIG. 5

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JC Rec'd PCT/PTO 25 APR 2005

Adjustable Electric Motor Brush Assemblies

Field of the Invention

The invention relates to the provision of adjustably movable brush holders in a fractional horsepower PMDC electric motor for the purpose of simplifying the assembly of electric motors, particularly electric motors with very small brush leaves.

Background of the Invention

In a conventional fractional-horsepower PMDC electric motor comprising a commutator, an end cap adjacent the commutator, two sheet metal brush leaves mounted for engagement with the commutator, and two brush holders respectively supporting the two brush leaves, the brush leaves are maintained in sliding contact on the commutator by means of spring loading and, in the case of small motors (with diameters of 20mm or less), it is common practice to form each brush leaf of resilient copper alloy, such as beryllium copper alloy, which is sometimes provided with a precious metal insert in the region where the brush leaf makes contact with the commutator.

Assembly of such a motor is effected by fitting the brush holders in the end cap in positions such that, when the space between the brush leaves is enlarged sufficiently to accommodate the commutator, the brush leaves exert the required pressure on the commutator. A mechanical device, for example: a device employing two pins which are movable in slots formed in the end cap, is then used to "open" the brush leaves in order to provide sufficient space between the brush leaves to allow the end cap to be attached to the remainder of the motor without the brush leaves interfering with the commutator. Once the end cap is in position, with the brush leaves on opposite sides of the commutator, the mechanical opening device is removed so as to allow the brush leaves to "close" on the commutator.

Clearly, this procedure involves opening the brush leaves to a greater extent during assembly than during use and in very small motors there is a danger that this distortion of the brush leaves will stress the brush leaves beyond their elastic limit.

Disclosure of the Invention

It is the purpose of the present invention to provide a fractional-horsepower PMDC electric motor in which this difficulty is at least reduced and, to avoid quality problems, manufacturers are able to avoid "opening" the brushes more than is strictly necessary.

This is achieved, according to the present invention, by providing an electric motor wherein each brush holder is movable, relative to the end cap, from a first position, in which the brush leaf mounted in the brush holder is radially clear of the commutator, to a second position, in which the brush leaf mounted in the brush holder is engageable with the commutator, and positioning means are provided for moving the brush holders from their first positions to their second positions.

Thus, according to the invention, there is provided a fractional horsepower PMDC electric motor in which two sheet metal brush leaves are respectively mounted in two brush holders and the two brush holders are respectively movable, relative to an endcap, from first positions in which the brush leaves are clear of a commutator to second positions in which the brush leaves are engageable with the commutator. By this means, it is possible to limit deformation of the brush leaves and therefore to limit the stress imposed on the brush leaves to the elastic limit of the material from which the brush leaves are formed.

In a preferred form of motor according to the invention, each brush leaf has a first portion extending parallel to

the axis of the motor and a second portion extending transversely of the axis of the motor for engagement with the commutator, and the brush holders are respectively formed with slots which receive the first portions of the brush leaves. In this case, movement of the brush holders from their first positions to their second positions, to bring the second portion of each brush leaf into engagement with the commutator can be effected simply by rotating the brush holder about the axis of the first portion of the brush leaf, or by a similar twisting movement of the brush holder.

It is also preferred that each brush holder is formed integral with the end cap and is connected to the end cap by a deformable interconnecting portion. This avoids the need to manufacture and assemble separate brush holders and provides a secure connection which does not suffer as a result of temperature changes and vibration which would adversely affect a frictionally held brush holder.

The integral formation of the brush holders also provides a precise pivoting axis and therefore a precise pressure with which the brushes mounted in these holders are pressed against the commutator.

In a practical embodiment having integral brush holders the end cap has a central portion, and an outer rim formed with two apertures, each brush holder has a radially inner portion and a radially outer portion, the interconnecting portions connect the radially inner portions of the brush holders to the central portion of the end cap, and the positioning means comprise two wedging members which are respective insertable in the two apertures formed in the outer rim of the end cap and respectively engageable with the radially outer portions of the brush holders to move the brush holders from their first positions to their second positions. This facilities adjustment of the brush

holders and has the further advantages that the brush holders are locked in the right position. With this form of construction, the end cap can be formed from relatively stiff material, which thereby facilitates accurate positioning of the end cap, and the wedging members can be formed of a relatively resilient material since their function is only to fill open spaces.

In the preferred embodiment the two wedging members are mounted on a common carrier member. In this case, both brush holders are moved from their first positions to their second positions by axial manipulation of the common carrier member. This allows faster manufacture (without any critical tolerances-dependant torque requirements as in frictional systems) as well as a very precise positioning of the brushes, as a result of the choice of adequate materials for the end cap and the wedging members. As explained, this optimal choice is made possible by the integral brush holders.

The radially outer portion of each brush holder may also be formed with at least one abutment surface and the outer rim of the end cap may be provided with seats which respectively receive the abutment surfaces when the brush holders are in their second positions so that the two wedging members respectively clamp the two brush holders against the seats. This ensures that the brush holders are positively located when in their second positions.

To prevent axial movement of the brush holders, the radially outer portion of each brush holder may be formed on opposite sides with axial abutment surfaces and the outer rim of the end cap may be formed with axial seats which are aligned with the axial abutment surfaces when the brush holders are in their second positions.

A preferred embodiment of the invention is hereinafter

described, by way of example, with reference to the accompanying drawings.

Brief Description of the Drawings

Figure 1 is a schematic sectional side elevation of one end of a fractional horsepower PMDC electric motor according to the invention;

Figure 2 is an end elevation of an electric motor shown in Figure 1;

Figure 3 is a part-sectional view of part of the electric motor shown in Figure 2; and

Figures 4 and 5 are schematic outer and inner elevational views of an end cap of the electric motor shown in Figures 1 and 2, showing one brush holder in a first position supporting a brush leaf radially clear of the commutator of the motor and one brush holder in a second position supporting a brush leaf for engagement with the commutator.

Best Mode for Carrying out the Invention

As shown in Figure 1, the housing 23 of a fractional horsepower PMDC electric motor has an end cap 2 fitted with a bearing 24 supporting one end of a motor shaft 25 carrying a commutator 1. The end cap 2 is integrally formed with two brush holders 4 respectively supporting the brush leaves 3 engaging the commutator 1. Positioning means, in the form of wedging members 5, are carried by a single, ring-shaped carrier member 12. Each brush leaf 3 has a first, terminal portion 19 extending parallel to the axis of the motor and a second portion 20 comprising six fingers 22, extending transversely of the axis of the motor, into engagement with the commutator 1. The first portions 19 of the brush leaves 3 are received in slots 21 formed, respectively, in the brush holders 4.

As the wedging members 5 are forced between each brush holder 4 and the adjacent side of the aperture 9 through which the brush holder 4 extends, the brush holder 4 and, therefore, the brush leaf 3 mounted in the brush holder 4 are swung in a clockwise direction, as shown in Figure 2. The carrier member 4 is therefore provided with divergent slot 27, as shown in Figure 2, to accommodate this movement.

As shown more clearly in Figures 3 and 4, each wedging member 5 is provided with a flexible cross-bar 22 which must be deformed to clear the side of the aperture 9 in the end cap 2, as the wedging member 5 is pressed into the aperture 9. When the cross-bar 22 passes through the aperture 9, it springs back into its undeformed shape to provide a snap fit beneath the edge of the aperture 9 to lock the carrier member 12 in place on the end cap 2.

As shown on Figures 4 and 5, each brush holder 4 extends across an aperture 9 formed in end cap 2. The brush holder 4 extends from a central portion 7 of the end cap 2 which is connected to a radially inner portion 10 of the brush holder 4 by a deformable interconnecting portion 6 of the end cap 2. When a wedging member 5 is inserted between one side of the aperture 9 and the outer portion 11 of the brush holder 4 as shown in Figure 4, the interconnecting portion 6 deforms and the brush holder 4 is swung in a clockwise direction from its first position, in which the fingers 26 of the brush leaf 3 are clear of the commutator 1, to its second position, in which fingers 26 of the brush leaf 3 engage the commutator 1.

CLAIMS

1. A fractional horsepower PMDC electric motor comprising:-

a commutator (1);

an end cap (2) adjacent the commutator (1);

two sheet metal brush leaves (3) mounted for engagement with the commutator (1); and

two brush holders (4) respectively supporting the two brush leaves (3);

characterised in that:-

each brush holder (4) is movable, relative to the end cap (2), from a first position, in which the brush leaf (3) mounted in the brush holder (4) is radially clear of the commutator (2), to a second position, in which the brush leaf (3) mounted in the brush holder (4) is engageable with the commutator (2); and

positioning means (5) are provided for moving the brush holders (4) from their first positions to their second positions.

2. A motor according to Claim 1 in which each brush holder (4) is formed integral with the end cap (2) and is connected to the end cap (2) by a deformable interconnecting portion (6).

3. A motor according to Claim 2 in which the end cap (2) has a central portion (7) and an outer rim (8) formed with

two apertures (9), the two brush holders (4) extend, respectively, across the two apertures (9), each brush holder (4) has a radially inner portion (10) and a radially outer portion (11), the interconnecting portions (6) connect the radially inner portions (10) of the brush holders (4) to the central portion (7) of the end cap (2), and the positioning means comprise two wedging members (5) which are respectively inserted in the two apertures (9) formed in the outer rim (8) of the end cap (2) so that each wedging member (5) extends between the outer portion of a brush holder (4) and one side of the aperture (9) across which the brush holder (4) extends to move the brush holders from their first positions to their second positions.

4. A motor according to Claim 3 in which the two wedging members (5) are mounted on a single carrier member (12).

5. A motor according to Claim 3 or Claim 4 in which the radially outer portion (11) of each brush holder (4) is formed with at least one radial abutment surface (13) and the outer rim (8) of the end cap (2) is provided with radial seats (14) which respectively receive the radial abutment surfaces when the brush holders are in their second positions so that the two wedging members (5) respectively clamp the two brush holders (4) against the radial seats (14).

6. A motor according to Claim 5 in which the radially outer portion (11) of each brush holder (4) is formed on opposite sides with first and second axial abutment surfaces (15 and 16) and the outer rim (8) of the end cap (4) is provided with first and second axial seats (17 and 18) which are respectively aligned with the axial abutment surfaces (15 and 16) when the brush holders (4) are in their second positions so that the two brush holders (4) are locked against axial movement.

7. A motor according to any one of Claims 3 to 6 in which each wedging member (5) is provided with a flexible cross-bar (22) for snap-fit engagement behind the end cap (2) when the wedging member (5) extends between a brush holder (4) and one side of the aperture (9) across which the brush holder (4) extends.

8. A motor according to any preceding claim in which each brush leaf (3) has a first portion (19) extending parallel to the axis of the motor and a second portion (20) extending transversely of the axis of the motor for engagement with the commutator (1), and the brush holders (4) are respectively formed with slots (21) which receive the first portions (19) of the brush leaves (3).

9. A fractional horsepower PMDC electric motor substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.

Examiner's report to the Comptroller under Section 17 (The Search Report)

Application number

9112101.2

Relevant Technical fields

(i) UK Cl (Edition K) H2A (AKA1D)

(ii) Int CL (Edition 5) H02K 13/00, 05/14; H01R 39/42, 39/44

Search Examiner

J COCKITT

Databases (see over)

(i) UK Patent Office

(ii) ONLINE DATABASES: WPI

Date of Search

30 JUNE 1992

Documents considered relevant following a search in respect of claims 1-9

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
	NONE	

Category	Identity of document and relevant passages	Relevant to claim(s)

Categories of documents

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